Thinking Outside the Grid:

Practical EV Charging Solutions for Grid-Constrained Rural and Gateway Communities

NASEO
National Association of State Energy Officials

CHARGE WEST

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Executive Summary

Rural and gateway communities are essential to a convenient and reliable national electric vehicle (EV) charging network. They connect residents and visitors to national and state parks, scenic byways, recreation areas, Tribal lands, freight routes, Main Streets, hotels, restaurants, small businesses, and emergency services. Yet these same communities often face the most difficult charging infrastructure conditions: long distances between destinations, seasonal travel peaks, limited three-phase power, utility equipment backlogs, and lower near-term utilization than urban or interstate locations.

What is a Gateway Community?

ChargeWest defines a gateway community as a town or locality that serves as a primary access point to a major destination such as a national park, state park, recreation area, scenic byway, public lands destination, resort area, or other visitor-serving destination. Gateway communities often experience seasonal travel peaks, high visitor-to-resident ratios, and infrastructure demands that exceed what local population alone would suggest.

For ChargeWest states and communities, a central question is not only where EV drivers need to charge, but how communities can make charging available when the preferred site lacks sufficient grid capacity. In many cases, the answer will be a phased and pragmatic approach: install the amount of charging the site can support now, design the site for future expansion, coordinate early with the utility, and consider load management, battery storage, on-site generation, or alternative sites when conventional grid service is delayed or uneconomic.

What is ChargeWest?

ChargeWest is an EV corridor collaborative across eight states in the Intermountain West region, including Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming. The collaborative is committed to improving electric corridors throughout rural gateway communities, state and national parks, and scenic byways by supporting consumer education, stakeholder engagement, and rural infrastructure development of electric vehicle charging from.

Grid constraints should not be viewed as a reason to defer rural charging indefinitely. Grid capacity is a planning variable that can be managed through better siting, better utility engagement, flexible interconnection, charging controls, distributed energy resources, and temporary or modular solutions. The most successful projects are likely to be those that match the charging solution to the use case: Level 2 charging where vehicles dwell for

several hours, DC fast charging where travelers need short stops, managed charging where loads can be shaped, and microgrid or battery-buffered charging where grid service is weak or delayed.

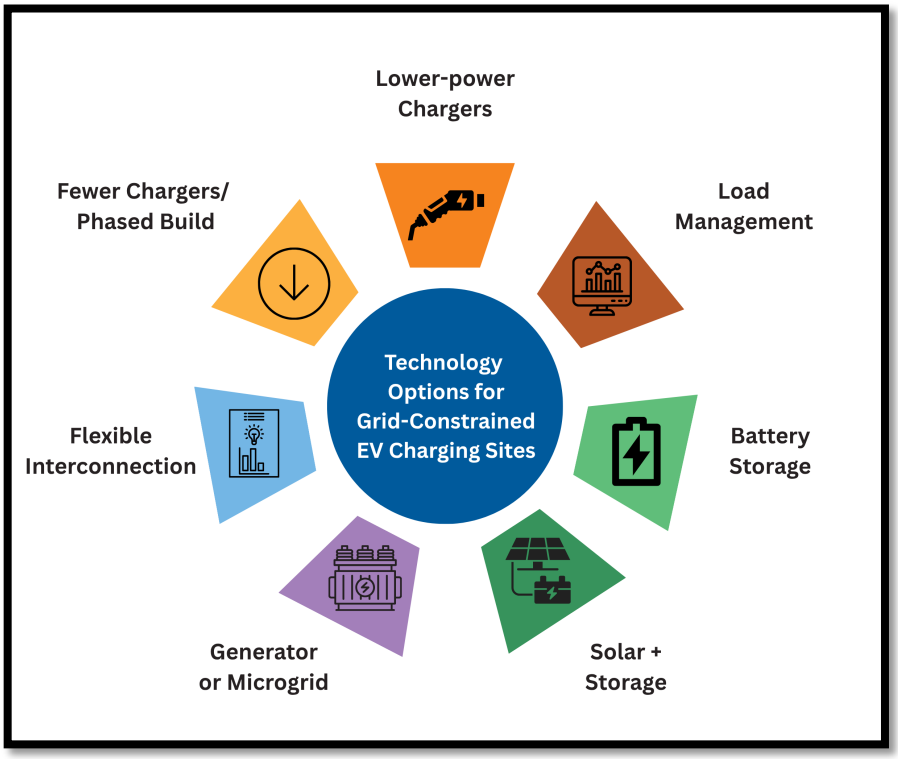
This report identifies technological solutions that can be deployed to support EV charging projects in grid-constrained areas; presents a decision framework for state and local officials, economic development organizations, tourism partners, utilities, charging providers, and site hosts; and emphasizes near-term implementation while preserving long-term optionality. The objective is to help communities meet EV driver demand while avoiding overbuilding, underbuilding, or waiting for ideal grid conditions that may take years to materialize. While the report is geared toward gateway communities and ChargeWest partner Clean Cities and Communities coalitions supporting this work at the local level, State Energy Offices and Departments of Transportation make excellent partners for this work.

Key Findings

- **EV charging is transportation infrastructure and economic development infrastructure.** A reliable charging stop can support visitor confidence, local spending, corridor continuity, and emergency travel, while also serving residents who lack convenient home charging.
- **Grid capacity is site-specific.** Moving a project across a street or to a neighboring parcel may change the available electrical capacity, upgrade cost, timeline, and utility process.
- **Utilities should be engaged before a site is considered final.** Early conversations can clarify available service, upgrade requirements, rate options, make-ready programs, meter needs, easements, transformer availability, and likely schedules.
- **Lower-power and phased deployments are often appropriate.** Level 2 charging and smaller initial DC fast charging installations can serve near-term demand while a community builds the case for later expansion.
- **Load management and battery storage can unlock constrained sites.** These solutions can keep site demand within panel, transformer, or feeder limits while improving operating economics by reducing exposure to peak demand charges.
- **On-site generation and microgrids are valuable tools, not default answers.** They should be evaluated where grid extension is slow, very costly, or impossible; where resilience is a priority; or where charging must support critical travel during outages.
- **Permitting, safety, and operations matter as much as hardware.** Jurisdictions should be prepared to permit EV charging, batteries, generators, solar, microgrids, and fuel systems; require appropriate certifications; and coordinate with first responders.

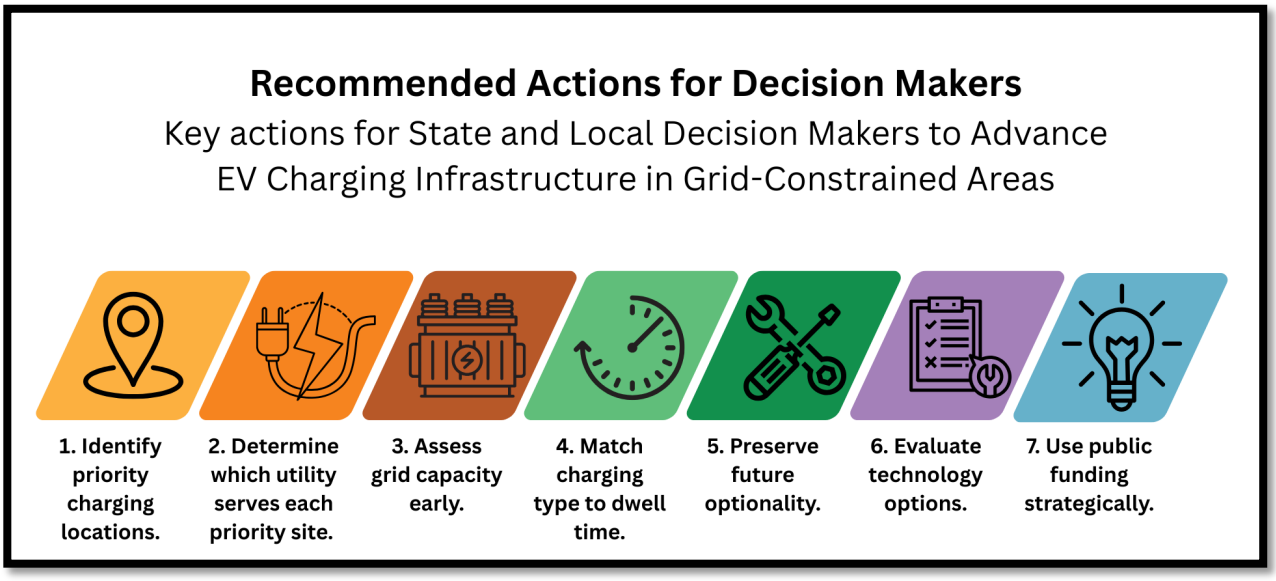
Technological Solutions for Grid-Constrained EV Charging Sites

Figure 1 Technology Options for Grid-Constrained EV Charging Sites



Recommended Actions for State and Local Decision Makers

Figure 2: Recommended Actions for Decision Makers



1. Identify priority charging locations based on travel patterns, tourism demand, community goals, emergency routes, and private-sector interest.
2. Determine which utility serves each priority site and establish a clear point of contact for EV charging projects.
3. Assess grid capacity early using hosting capacity maps where available, utility pre-application processes, and site-specific load letters.
4. Match charging type to dwell time: Level 2 for hotels, trailheads, downtowns, parks, and long visits; DC fast charging for corridor stops and high-turnover sites.
5. Preserve future optionality through site design, conduit sizing, switchgear planning, and space for additional chargers, batteries, and/or generation.
6. Evaluate technology options using a common screen: reliability, customer experience, power need, cost, emissions profile, resilience value, permitting complexity, and expected duration of need. Technology options are outlined in Table 2.
7. Use public funding strategically to de-risk projects that have high public value but challenging near-term economics. State Energy Offices and Departments of Transportation make excellent partners for this work.

As states, local governments, chambers of commerce, tourism boards, Clean Cities and Communities coalitions, and other stakeholders work to support gateway communities with EV charging infrastructure planning and construction, they can draw on the solutions included in this assessment to address local challenges around grid capacity. What works for one community may not always work for another, but by utilizing innovative technological solutions, gateway communities can ensure that EV charging is built where it is needed.

Introduction

As EV adoption continues to grow, access to reliable public charging is increasingly important for both residents and visitors. For rural and gateway communities, charging access is closely tied to tourism, regional mobility, local business activity, and confidence in long-distance EV travel. The U.S. Department of Transportation's rural EV charging toolkit emphasizes that rural stakeholders, including property owners, businesses, towns, Tribes, and planning agencies, can play a direct role in scoping, planning, funding, and implementing EV charging projects.[i]

In the Intermountain West, these issues are particularly important. Distances between communities can be long, visitor travel is often seasonal, and many high-value destinations are located far from large load centers. ChargeWest was created to help address these conditions by supporting EV corridor development and rural infrastructure deployment across eight western states.[ii]

The challenge addressed in this report is straightforward: many of the places where charging is most needed are not always the places where electric power is most readily available. A downtown parking lot, national park gateway, trailhead, hotel, convenience store, visitor center, or freight rest area may be well located from a transportation standpoint but constrained from an electrical standpoint. In some cases, the issue is insufficient service at the building. In others, the local transformer, distribution line, or feeder cannot serve the requested charging load without upgrades. In more remote areas, a site may have no practical grid connection at all.

What is a Gateway Community?

ChargeWest defines a gateway community as a town or locality that serves as a primary access point to a major destination such as a national park, state park, recreation area, scenic byway, public lands destination, resort area, or other visitor-serving destination. Gateway communities often experience seasonal travel peaks, high visitor-to-resident ratios, and infrastructure demands that exceed what local population alone would suggest.

Why Charging Access Matters for Rural Economic Development

Charging availability can influence whether EV drivers choose to visit a community, stay overnight, stop for a meal, or spend time at local businesses. The value proposition is therefore broader than kilowatt-hours sold at a charging station. Charging can help

communities capture visitor spending, support local lodging and retail, improve corridor continuity, and signal that a destination is ready for current and future travel behavior. EV charging also has public-sector value. Reliable charging along rural routes can support emergency response, evacuation planning, intercity travel, access to health care, and mobility for residents who drive longer distances. Charging investments can complement broader local priorities, including air quality, energy resilience, fleet modernization, and business attraction.

EV Growth and Travel Patterns

National EV market projections vary by policy, technology, and consumer assumptions. The Energy Information Administration's Annual Energy Outlook 2026 provides a federal baseline and alternative scenarios for transportation energy use and vehicle adoption, underscoring the need for infrastructure planning that can adapt to uncertainty.[iii] For rural and gateway communities, planning should not rely only on statewide EV counts. It should also consider trip purpose, dwell time, corridor use, visitor origin, seasonal peaks, rental car activity, second-home travel, and whether households with multiple vehicles are using internal combustion vehicles for certain trips due to charging concerns.

Planning tools can help. The Alternative Fuels Data Center's EVI-X Toolbox includes tools for estimating daily charging needs, long-distance travel charging needs, load profiles, and related infrastructure scenarios.[iv] These tools are valuable starting points, but state and local officials should supplement them with local tourism data, traffic counts, lodging occupancy trends, park visitation data, and input from charging developers and utilities. This data can often be obtained from state-level Economic Development and Tourism Offices, State Departments of Transportation, National and State Park Service entities, and local Chambers of Commerce, which often have local visitor and lodging tax data.

EV Charging Needs in Rural and Gateway Communities

Charging needs are shaped by the reason a driver is in the community. A resident charging overnight at home has a different need from a family stopping for lunch on the way to a national park, a rental car visitor staying at a hotel, a parks employee driving a light-duty fleet vehicle, or a delivery truck serving local businesses. The most effective charging strategies begin by matching charging speed, location, and operating model to expected use.

Table 1: Charging Speeds and Typical Use Cases

Charging type	Typical power range	Best-fit rural/gateway use cases	Grid implications
Level 1	1-2 kW	Long-duration residential or workplace charging; limited role for public visitor charging.	Often feasible on existing circuits but too slow for most visitor needs.
Level 2	6-19 kW per port	Hotels, downtown parking, visitor centers, parks, trailheads, workplaces, multifamily housing, and locations with dwell times of several hours or overnight.	Often easier and less costly to interconnect than DC fast charging; multiple ports can still create sizeable load.
DC fast charging (DCFC)	50-350+ kW per dispenser; site loads can reach hundreds of kW or multiple MW	Corridor stops, convenience stores, travel plazas, high-turnover visitor hubs, emergency routes, fleet depots, and freight locations.	May require three-phase power, transformer upgrades, service upgrades, feeder work, easements, and longer utility timelines.
Megawatt-scale charging	1 MW and above	Medium- and heavy-duty trucks, high-throughput depots, and major logistics hubs.	Often requires substantial distribution or transmission-level planning, managed charging, storage, or dedicated energy supply.

The goal is not always to deploy the fastest charger possible. In many rural tourism settings, Level 2 charging may provide the greatest value per dollar where vehicles dwell for hours. DC fast charging is more important where travelers need to continue quickly, where distances between communities are long, or where the charging site serves a corridor function.



The goal is not always to deploy the fastest charger possible.

Understanding Grid Capacity and Utility Context

A charging station is both a transportation project and an electrical infrastructure project. While a site may appear ideal for drivers, it may not have sufficient grid capacity and may need new service wiring, switchgear, conduit, transformers, or distribution upgrades

before chargers can operate. These upgrades can affect cost, schedule, and project feasibility. In rural areas, the local distribution system may have been designed for relatively modest loads, and the distance to larger utility infrastructure may be significant. Transformer backlogs can add months or even years to a project timeline. Time to power is one of the key variables in charging developers' "formula for profit".[v] Time is money, and charging providers often cannot wait for grid upgrades in order to begin turning a profit on a site.

Grid upgrades can affect cost, schedule, and project feasibility.



Why Power May Not Be Available Where Charging Is Needed

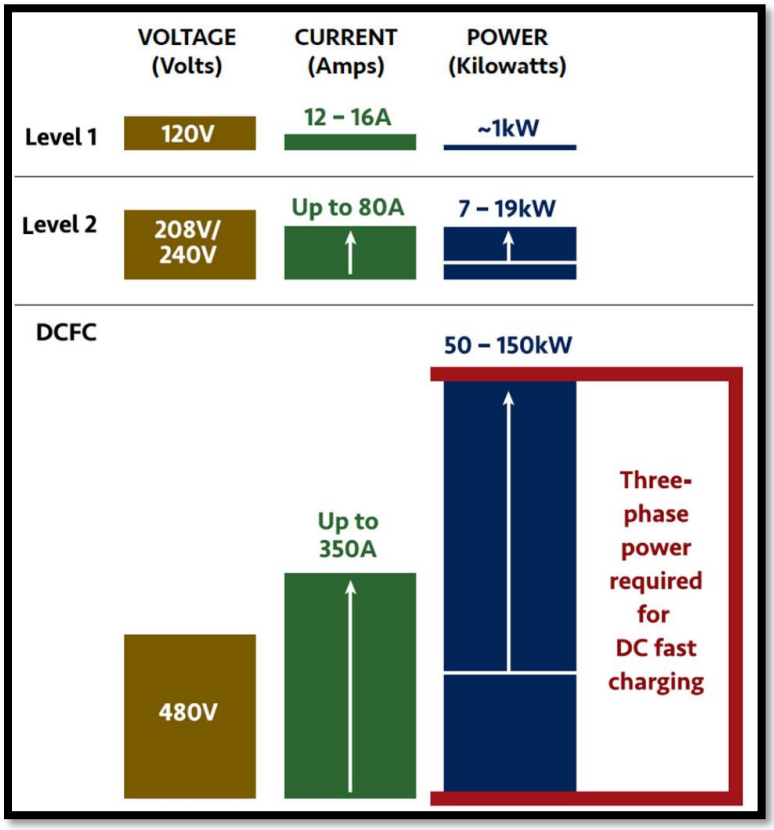
Utilities plan and operate distribution systems to balance safety, reliability, affordability, and customer needs. Adding EV charging can create new peak loads that exceed the existing capacity of a building panel, service transformer, distribution line, or feeder. The issue is especially pronounced for DC fast charging, where a small number of chargers can require hundreds of kilowatts of capacity and where larger sites can reach megawatt-scale loads.

Local distribution upgrades, including three-phase service extensions and transformer installations, can add substantial time and cost. Equipment availability can also affect schedules, particularly for transformers and switchgear. As a result, communities should treat utility coordination as an early planning activity rather than a late-stage construction step.

The Role of Three-Phase Power

Many high-power charging installations depend on three-phase power because it can deliver large amounts of electricity more efficiently and reliably than typical single-phase service. While Level 2 chargers may be feasible at many existing commercial buildings, DC fast charging sites often need three-phase service and appropriately sized transformers, panels, and protection equipment. Where three-phase power is not nearby, extension costs and timelines can determine whether a project is viable.

Figure 3: Electricity Needs for Different Charging Speeds (USDOT Volpe Center)[i]



Public Power, Rural Electric Cooperatives, and Investor-Owned Utilities

Utility structure matters. Many gateway communities are served by public power utilities or rural electric cooperatives rather than investor-owned utilities. Public power utilities are community-owned, not-for-profit utilities that serve more than 55 million Americans in approximately 2,000 communities combined.[vi] Electric cooperatives are private, not-for-profit utilities owned by their customers or members. Cooperatives serve 42 million people across 56 percent of the U.S. landmass.[vii]

These utilities may be governed by local boards or member-elected boards and may not be regulated by the state public utility commission in the same way as investor-owned utilities. This can create both opportunities and constraints. Public power utilities and co-ops often know their communities well and may be able to coordinate closely on priority sites. At the same time, they may have limited staff capacity, smaller capital budgets, and fewer formal EV charging programs than large investor-owned utilities.

One utility type is not inherently easier to work with than another. Rather, project sponsors should learn how the local utility makes investment decisions, how costs are allocated,

what approvals are needed, whether make-ready or EV rates are available, and how the utility evaluates new load from seasonal or uncertain charging demand.

Determining Grid Capacity at a Potential Charging Site

Assessing grid capacity should begin before a site is selected, land is leased, or grant funds are committed. State and local officials can help by creating a clear pathway for site hosts and developers to identify the serving utility, understand likely power availability, and compare sites based on both transportation value and electrical feasibility. Key steps for engaging relevant utilities are detailed below.



Assessing grid capacity should begin before a site is selected, land is leased, or grant funds are committed.

Utility Engagement

- **Identify the serving utility.** Use utility lookup tools (such as the U.S. Department of Energy's "U-Finder") and local knowledge to confirm the electric provider for each candidate site.
- **Describe the project clearly.** Share the number of chargers, expected power ratings, desired opening date, site plan, preliminary load estimate, and whether future expansion is expected.
- **Ask about available service and upgrades.** Request information on existing service, transformer capacity, three-phase availability, required studies, easements, metering, and construction timelines.
- **Clarify rates and tariffs.** Ask whether EV charging rates, demand charge alternatives, time-of-use rates, or separate metering requirements apply.
- **Discuss make-ready support.** Some utilities offer programs that help pay for utility-side or customer-side infrastructure needed to prepare a site for EV chargers. Availability varies widely, particularly among municipal utilities and co-ops.
- **Plan for equipment lead times.** Ask about transformer and switchgear availability and whether the utility maintains inventory that could support priority charging deployments.

Hosting Capacity Maps

Hosting capacity maps show where distribution systems may have available capacity and where constraints may exist. DOE maintains a U.S. Atlas of Electric Distribution System Hosting Capacity Maps, which identifies utilities and states with public maps. Maps are available from dozens of utilities or state agencies, but coverage is uneven and does not necessarily cover an entire state.[viii]

Hosting capacity maps can help developers and communities screen sites earlier, reduce speculative applications, and focus utility conversations. Atlas Public Policy has noted that hosting capacity maps can reduce costs and shorten project timelines by giving developers more information about available electrical capacity and potential constraints.[ix] Where a utility does not publish a map, the project team should request a site-specific assessment directly from the utility.

What to Ask the Utility:



1. *What power is available at this parcel today?*
2. *Is three-phase service available nearby?*
3. *What upgrades would be triggered by the proposed charging load?*
4. *What is the likely design, procurement, and construction timeline?*
5. *Are there EV rates, make-ready incentives, demand charge alternatives, or managed charging options?*
6. *Can the site use load management, storage, or flexible service to reduce or defer upgrades?*
7. *What future expansion should be planned now to avoid retrenching or redesigning the site later?*

Solutions for Grid-Constrained Charging Sites

When a priority site lacks adequate power, communities and developers can consider a menu of solutions. These options are not mutually exclusive. A project may combine a smaller initial charger count, lower-power chargers, load management, battery storage, and futureproofed electrical work while waiting for a utility upgrade. The appropriate solution depends on the site use case, duration of the grid constraint, budget, permitting environment, and reliability needs.

Install Fewer Chargers Initially

A phased approach can allow a project to serve drivers sooner while preserving the ability to expand later. For example, a site originally planned for six DC fast chargers may begin with four if that is what existing service can support. The project team can still design the site for future growth by installing larger conduit, reserving space for additional dispensers, planning switchgear and pads, and coordinating with the utility on the next transformer or service upgrade. This approach is most appropriate where near-term demand is uncertain, where the utility upgrade is expected but delayed, or where public funds can help futureproof civil work now.

Intermountain West Example

Rivian Adventure Network

Monticello, Utah

*In 2025, **Rivian** opened a new station as part of their expanding Adventure Network. Located in Monticello, Utah, near Canyonlands National Park, Rivian settled for four 300 kW DCFC chargers, despite originally wanting to install six. There simply wasn't grid capacity to support six fast chargers, but Rivian determined that the location was important enough to still invest.*



Photo: Blue Mountain Foods

Install Lower-Power Chargers

Lower-power charging can be a strong fit for many rural and gateway locations. Level 2 charging is generally less expensive to procure and install than DC fast charging and is more likely to work with existing electrical service. It is particularly valuable at hotels, campgrounds, downtown parking areas, visitor centers, trailheads, ski areas, museums, restaurants, and other locations where vehicles are parked for multiple hours. Lower-power DC fast chargers can also be considered where 150 kW or 350 kW charging is not feasible or not needed.

Intermountain West Example

Teton County Parks and Recreation

Jackson, Wyoming

*In mid 2026, **Teton County Parks and Recreation** installed a Level 2 charging station at their Vehicle Fleet Maintenance Facility to support charging of both fleet and employee vehicles. Since vehicles tend to be parked at the facility for long periods of time, Level 2 charging was deemed to be sufficient for the department's needs.*

Yellowstone-Teton Clean Cities provided the Level 2 charging station through their Level 2 Charger Rebate Program, which is funded by the Teton Conservation District.

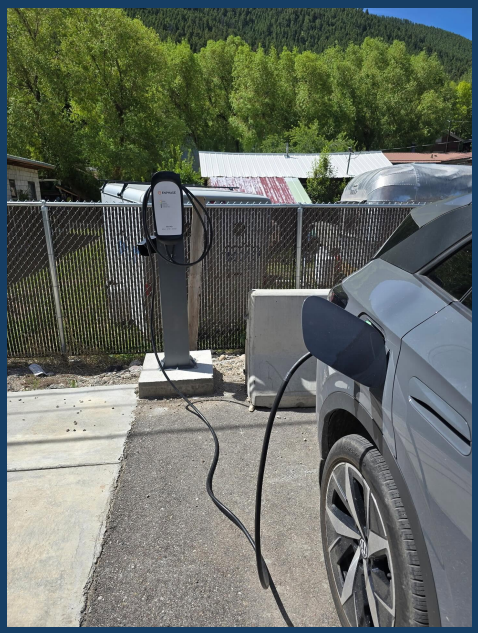


Photo: Yellowstone-Teton Clean Cities

Use Load Management and Charge Management

Load management uses hardware, software, or both to ensure that a charging site does not draw more power than the electrical service can safely provide. It can allocate power equally across vehicles, prioritize the first vehicle that plugs in, reserve one high-power plug for critical needs, or respond dynamically to building load and utility signals. Charge management is ideal for locations that may not require 24/7 nameplate charging capacity but instead can meet customer needs while varying charging speeds.

For public charging, controls should be designed carefully so that customers still receive a reliable and understandable charging experience. For fleet charging, load management may be easier because vehicle schedules and energy needs are known in advance.

In addition to load management software, distributed charging architectures can further support charge management. Distributed charging systems feature power units that are separate from distributed “satellite” charging ports. Using dynamic power routing, power can be re-routed during charging to deliver more charging sessions in the same timeline. This enables optimal power to be seamlessly re-routed based on each individual EV’s charging behavior, ensuring the best user experience and improved cost efficiency. For retail charging, this means site hosts can sell more electrons faster. For fleets, this means EVs spend less time at the charger and more time on the move.

Intermountain West Example

Jacksons Food Stores

Fruitland and Nampa, Idaho

*In 2026, **Jacksons Food Stores** partnered with **OnPoint EV Solutions** to install DCFCs at locations across the West, including Idaho, Washington, and California. Idaho sites in Nampa and Fruitland utilize **Kempower's** distributed charging system, where a centralized Power Unit dynamically distributes power to Satellite charging dispensers. These sites are both located along I-84, which make them useful for both local drivers and people traveling longer distances.*

Idaho continues to see steady growth in both personal and commercial EVs. Travel corridors need dependable fast charging, and more property owners and fleet operators are looking for solutions that generate revenue without creating a lot of extra work.



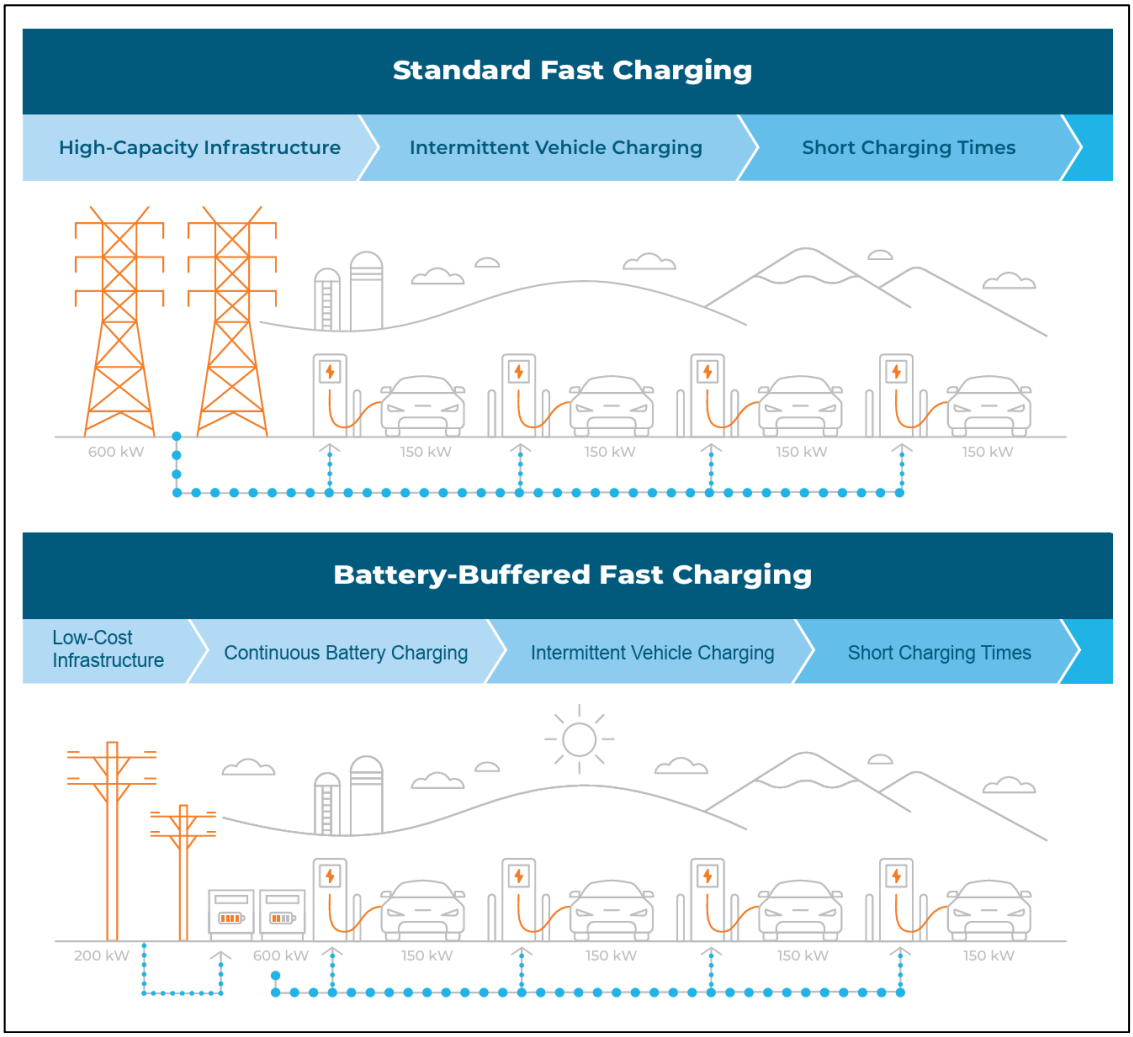
Photo: OnPoint EV Solutions

Add Battery Energy Storage

Battery energy storage systems can charge slowly from the grid and discharge quickly to support higher-power EV charging. Storage can reduce peak demand, manage demand charges, provide backup power, and reduce or defer the need for utility upgrades. It can also be paired with solar or other on-site generation. Battery-buffered charging is especially relevant where the grid can provide some power, but not enough to support the full instantaneous charging load.

Battery energy storage systems can reduce peak demand, manage demand charges, provide resilient backup power, and reduce or defer the need for utility upgrades.

Figure 4: Standard vs Battery-Buffered Fast Charging (JOET)[x]



While most battery-buffered systems today use new batteries, companies are beginning to pilot utilizing second life EV batteries. These batteries offer substantial cost savings, particularly for use cases in which the cost of a new battery may make a return on investment less likely. For example, rural and off-grid chargers often see low utilization rates and may not require new batteries with high capacities.[xi]

Intermountain West Example

Electric Era NEVI Station

Deming, New Mexico

*In January 2025, **Electric Era** opened New Mexico's first fast-charging station funded by the National Electric Vehicle Infrastructure (NEVI) Program. To rapidly develop the site in just over six months for **Skycharger**, the site owner, Electric Era combined its patented technology with turnkey solutions that included site acquisition, station design, utility coordination, and construction. They were able to circumvent capital intensive upgrades with their battery-backed design. Furthermore, Electric Era collaborated closely with **Columbus Electric Co-Op** and site host **Bowlin's Travel Centers**, located in Akela Flats along the key I-10 corridor in Deming, New Mexico.*

This was the first of 18 NEVI sites that Electric Era is building for Skycharger in New Mexico, California, and other states.



Photo: Electric Era

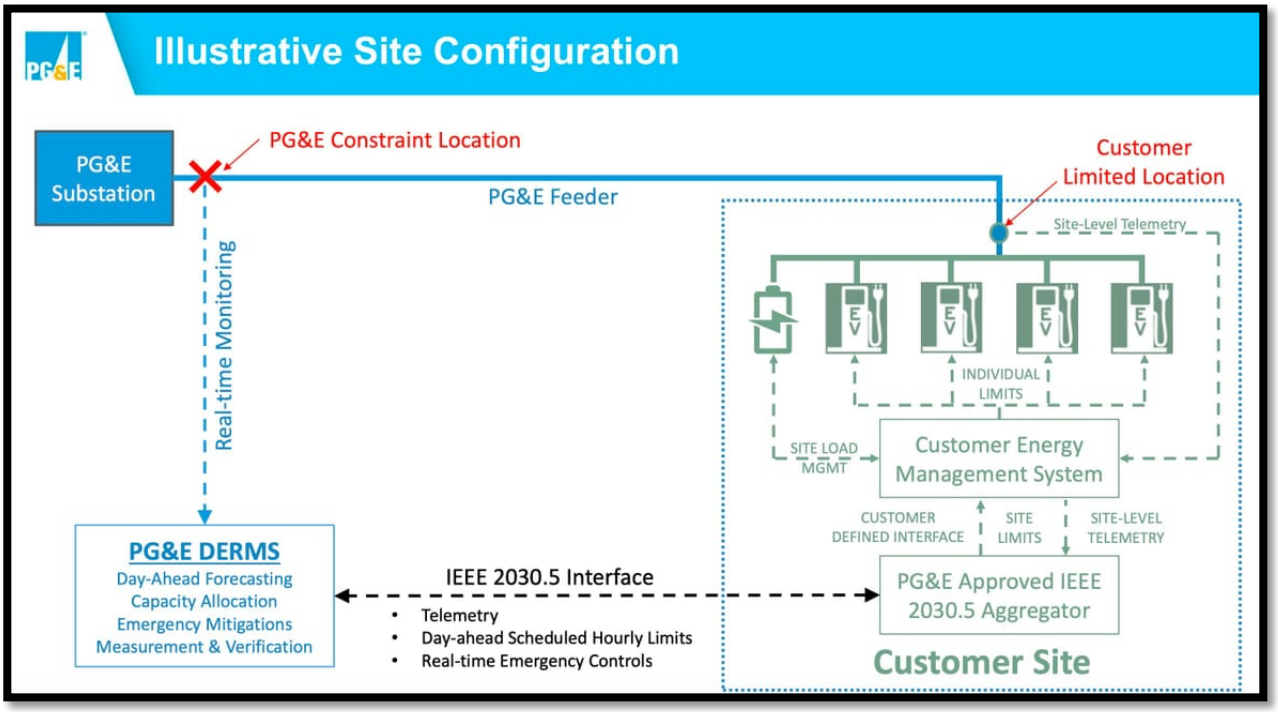
The market has evolved quickly; communities should evaluate provider financial strength, service obligations, warranties, and long-term operations support before selecting a vendor.

Explore Flexible Interconnection or Flexible Service

Flexible interconnection and related flexible service models allow a customer to connect to the grid under operating limits that change based on grid conditions. DOE's flexible DER and EV connections work describes dynamic operating envelopes, flexible interconnection, and flexible service connections as emerging strategies that can help use existing grid capacity more efficiently.[xii] For EV charging, this could allow a site to operate sooner or at lower cost if the customer accepts limits during constrained periods. These approaches require utility capability, communications, clear operating rules, and customer understanding of service limitations. As such, only a handful of utilities in the U.S. are offering pilot programs.

For example, Pacific Gas and Electric (PG&E)'s new Flexible Service Connection program, known as Flex Connect, allows customers with controllable power needs, like EV chargers, to connect to the grid without needing to wait for capacity upgrades.[xiii] EV charging company, Revel, plans to take advantage of this Flex Connect program to fast-track two of its upcoming stations – one in the city of Oakland and another near San Francisco International Airport.[xiv]

Figure 5: Illustrative Site Configuration (PG&E)



Notably, national standards for testing and certifying the automated load management equipment needed to ensure that customer sites keep their grid draws under prescribed limits do not yet exist. Until those standards are in place, every utility must enforce their own requirements to ensure safety.

To scale, utilities and regulators will need to develop established regulatory procedures to govern the use of Load Control Management System (LCMS) technology outside of the case-by-case basis being used for pilot projects.

Generate Power on Site

Where grid service is unavailable, insufficient, or delayed for an extended period, on-site power can supplement or replace grid supply. Options include solar plus storage, propane or diesel generators, natural gas generators, microturbines, fuel cells, and linear generators. The best option depends on fuel availability, emissions goals, operating hours, permitting rules, safety requirements, noise restrictions, cost, resilience value, and whether the solution is temporary or permanent.

On-site power generation options include solar plus storage, propane or diesel generators, natural gas generators, microturbines, fuel cells, and linear generators.

Intermountain West Example

Behind the Fence Fleet Charging

Las Vegas, Nevada

*In Las Vegas, Nevada, a last mile delivery fleet deployed **U.S. Energy's Volt Vault Level 2** product behind the fence at their depot to support their daily charging. The unit is a trailer-based system and features 16 charging ports. The electricity is generated on-site on demand via a natural-gas-fueled generator. The fleet was able to get this unit up and running in a much quicker timeframe than upgrading their electrical grid connection and without any additional construction. The Volt Vault system can generate electricity using other fuels such as propane, allowing fleet operators to select the fuel source that best aligns with site conditions, infrastructure, and operational needs.*



Photo: U.S . Energy

Intermountain West Example

Aspen Community School

Aspen, Colorado

*In 2020, **Aspen Community School** partnered with **Skyhook Solar, SWTCH Energy, and LG Electronics** to develop a fully off-grid Level 2 EV charging station. The system features a 3.24kW bifacial PV array paired with a 19.2kWh LiFePO4 battery storage system. The station provides two Level 2 charging ports using the standard Type 1 (SAE J1772) connector, delivering a combined output power level of 3.6kW. Since being deployed, the system has charged an estimated 4,628 EV miles.*

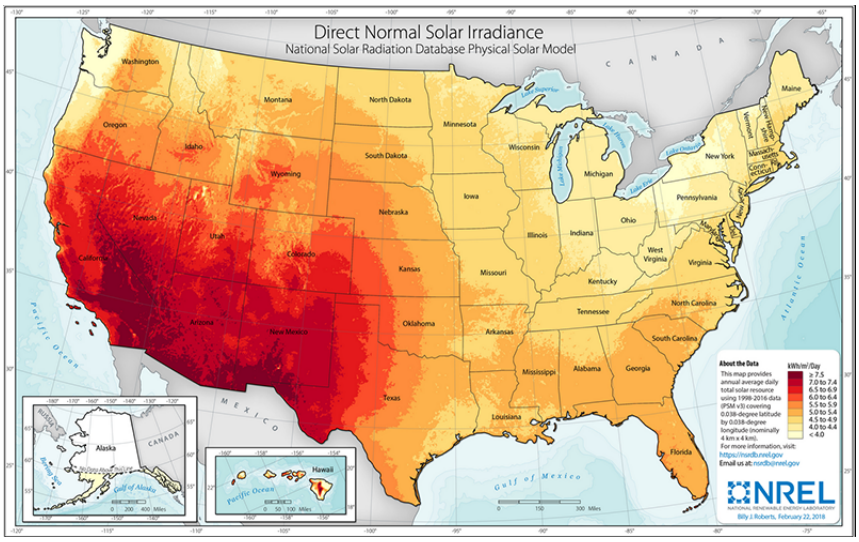
The energy output is dependent on environmental factors, such as cloud cover and storms, though by utilizing this system, the school was able to mitigate the disruption of traditional site construction and the environmental impact of grid-heavy expansion. Furthermore, the system is focused on maximum resilience and a minimal carbon footprint, relying on renewable energy.



Photo: Skyhook Solar

Solar-based solutions like the one above may be particularly effective in the Intermountain West, where the natural potential for solar-power generation is strong.[xv]

Figure 6: U.S. Average Annual Solar Radiation (U.S. DOE)[xvi]



Intermountain West Example

Off-Grid Temporary Charging for Burning Man

Gerlach, Nevada

*In fall 2025, **ElectricFish** temporarily deployed one of their 400squared chargers to support fast EV charging (up to 400 kW) for Burning Man Festival attendees in northern Nevada. The closest permanent fast chargers to the Black Rock Desert "Playa," where the festival is held, are approximately 100 miles away in either Fernley or Wadsworth, Nevada. That means anyone wanting to drive their EV to the festival must plan around the true charging desert limitations of the region.*

ElectricFish's charger has an integrated large battery (400 kWh) for power storage, and for this off-grid deployment, they paired the charger with a lower-powered 30 kVA diesel generator. The whole unit can be installed in under two hours, even when connected to the grid, though this off-grid solution was much faster.



Photo: ElectricFish

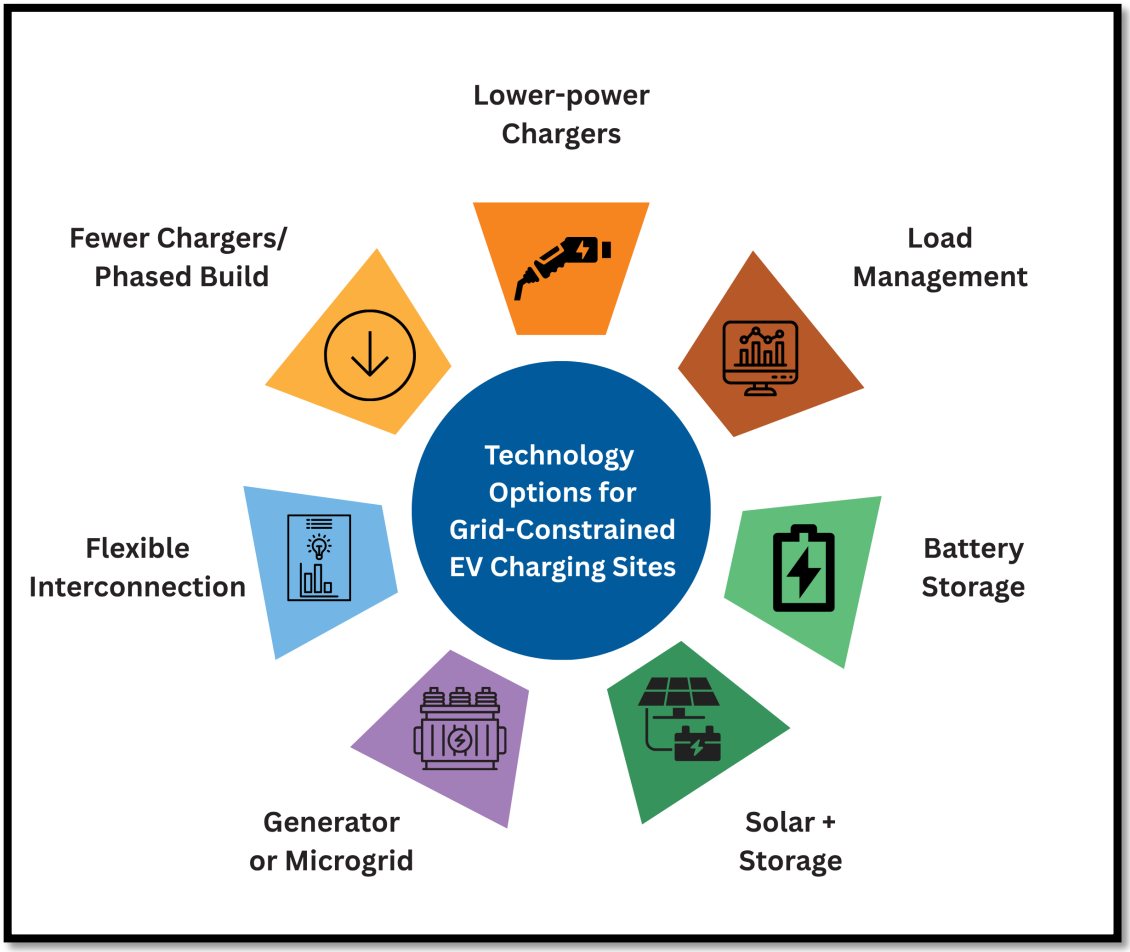
Consider an Alternative Site

Sometimes the most cost-effective solution is to move the project. A nearby parcel may have stronger electrical service, easier three-phase access, better transformer capacity, fewer easement issues, or a utility upgrade that is already planned. Local governments can add value by helping developers compare sites, coordinating with landowners, and aligning charging locations with community development goals.

Comparing Technology Options

The menu of technological solutions identified above is summarized in Figure 7 on the following page.

Figure 7: Technology Options for Grid-Constrained EV Charging Sites



The table below provides an overview of these technology options, including their advantages, limitations, and notes for procurement.

Table 2: Grid-Constrained EV Charging Technology Options Comparison

Option	Best fit	Advantages	Limitations	Key Questions and Notes for Procurement
Fewer chargers / phased build	Temporary grid constraints; uncertain demand	Gets service online sooner; preserves capital; can futureproof civil work	May create queues during peak seasons; requires expansion plan	What can the site support today, and what work can be done now to avoid rework later?
Lower-power chargers	Long dwell times; lodging and recreation destinations	Lower cost; easier interconnection; strong visitor amenity	Not sufficient for quick corridor stops	How long will drivers naturally park at the site?
Load management	Panel or transformer constraints; fleet depots; multi-port public sites	Uses existing capacity better; can reduce demand charges	Can reduce charging speed if poorly designed; may require utility-approved controls	Can power be shared without undermining user experience? Require interoperability, fail-safe operation, cybersecurity review, clear user experience, and utility acceptance.
Battery storage	Sites with limited grid capacity but some grid access	Buffers demand; improves economics; can support resilience	Adds cost, space, permitting, fire safety planning, and O&M needs	What battery size is needed, and how will it be operated? Check fire code, UL certification, warranties, battery augmentation, O&M responsibilities, and vendor bankability.
Solar + storage	Sunny sites; resilience and sustainability goals; limited grid capacity	Reduces grid draw; no fuel deliveries; strong fit in much of the rural West	Intermittent output; storage needed for reliability; land and permitting needs	Does the site have space, solar resource, and operations capacity? Evaluate land, interconnection, snow, wildfire, operations, and realistic seasonal output.
Generator or microgrid	No grid access; long utility delays; critical routes; high power needs	Can provide power quickly and independently; supports resilience	Fuel supply, emissions, noise, permitting, and operating cost concerns	Is the need temporary or permanent, and what fuel is available? Assess fuel

Option	Best fit	Advantages	Limitations	Key Questions and Notes for Procurement
				availability, emissions profile, noise, permitting, O&M, and suitability for continuous or backup operation.
Flexible interconnection	Utilities with flexible service capability; constrained feeders	May accelerate energization and reduce upgrade costs	Not widely available; requires controls and clear operating limits	Can the site operate under variable limits? Requires utility program design, communications standards, customer obligations, and clear service expectations.

Conclusion

Rural and gateway communities do not need to wait for perfect grid conditions to begin planning and deploying EV charging. They do, however, need a disciplined approach that recognizes both transportation needs and electrical realities. The best projects will be designed around local use cases, coordinated early with utilities, and structured to deliver near-term benefits while preserving long-term expansion options.

Key Findings

Key findings of ChargeWest's research into this topic include:

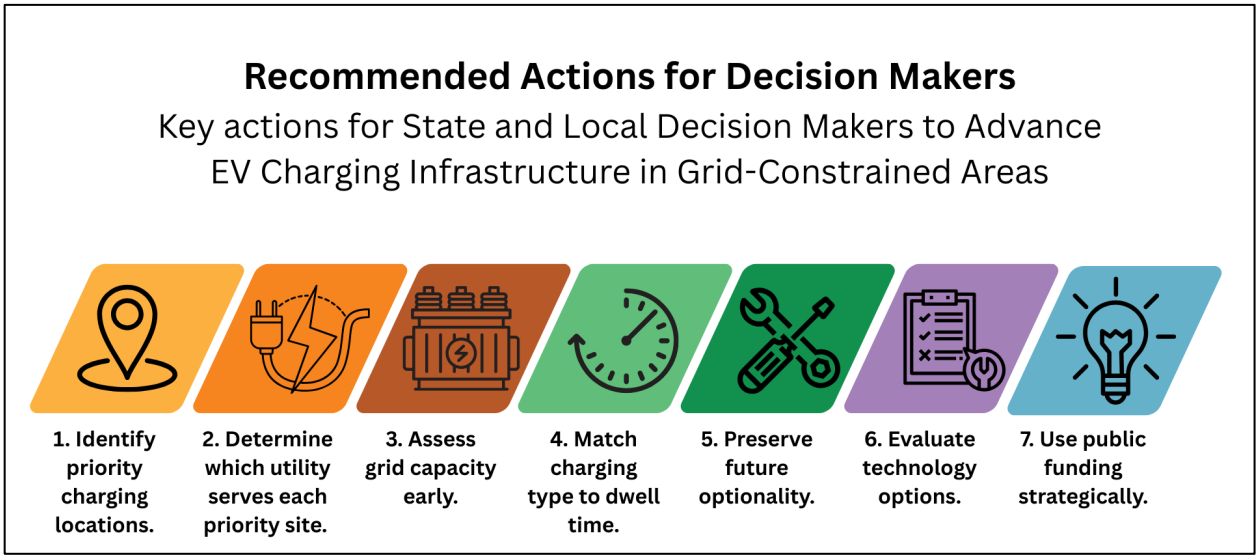
- **EV charging is transportation infrastructure and economic development infrastructure.** A reliable charging stop can support visitor confidence, local spending, corridor continuity, and emergency travel, while also serving residents who lack convenient home charging.
- **Grid capacity is site-specific.** Moving a project across a street or to a neighboring parcel may change the available electrical capacity, upgrade cost, timeline, and utility process.
- **Utilities should be engaged before a site is considered final.** Early conversations can clarify available service, upgrade requirements, rate options, make-ready programs, meter needs, easements, transformer availability, and likely schedules.

- **Lower-power and phased deployments are often appropriate.** Level 2 charging and smaller initial DC fast charging installations can serve near-term demand while a community builds the case for later expansion.
- **Load management and battery storage can unlock constrained sites.** These solutions can keep site demand within panel, transformer, or feeder limits while improving operating economics by reducing exposure to peak demand charges.
- **On-site generation and microgrids are valuable tools, not default answers.** They should be evaluated where grid extension is slow, very costly, or impossible; where resilience is a priority; or where charging must support critical travel during outages.
- **Permitting, safety, and operations matter as much as hardware.** Jurisdictions should be prepared to permit EV charging, batteries, generators, solar, microgrids, and fuel systems; require appropriate certifications; and coordinate with first responders.

Recommended Actions for Decision Makers

Keeping the above findings in mind, decision makers should take the following actions when planning for EV charging sites within grid-constrained areas:

Figure 8: Recommended Actions for Decision Makers



1. Identify priority charging locations based on travel patterns, tourism demand, community goals, corridor continuity, emergency routes, and private-sector interest. Treat EV charging as critical transportation infrastructure and as a tool for local economic development.

2. Determine which utility serves each priority site and establish a clear point of contact for EV charging projects. Engage the relevant utility as early as possible.

3. Assess grid capacity early using hosting capacity maps where available, utility pre-application processes, and site-specific load letters. If capacity is insufficient, consider whether there may be a nearby site with similar transportation value and better electrical capacity. If not, work to understand whether the grid constraint is short-term, multi-year, or permanent, as well as what studies, upgrades, easements, equipment, and approvals will be required to energize the site.
4. Match charging type to dwell time, considering whether drivers will park for 20-40 minutes, several hours, overnight, or all day. Consider Level 2 charging as a core rural tourism strategy, not merely a secondary option. Generally, Level 2 chargers are a good fit for hotels, trailheads, downtowns, parks, and long visits, while DC fast charging makes sense for corridor stops and high-turnover sites.
5. Preserve future optionality through site design, conduit sizing, switchgear planning, and space for additional chargers, batteries, and/or generation. Right-size the first phase of deployment and futureproof where practical.
6. Evaluate technology options using a common screen: reliability, customer experience, power need, cost, emissions profile, resilience value, permitting complexity, and expected duration of need. Technology solutions may include managed charging software and/or hardware, on-site energy storage, and/or on-site power generation. When evaluating technology options, decision makers should also consider the feasibility and speed of local jurisdiction permitting for each technology, as well as training needs for local emergency responders. All sites should include clear emergency shutoff, signage, and operating procedures, focused on safety.
7. Use public funding strategically to fill market gaps and de-risk projects that have high public value but challenging near-term economics. State Energy Offices and Departments of Transportation make excellent partners for this work. Be sure to understand design and hardware implications of any state or federal grants the project plans to utilize. Public funding may also be strategically used to support resilience, such as ensuring sites can operate during outages or support evacuation, emergency response, or critical services. Public funds may also be leveraged to support first responder training for EVs, charging equipment, battery storage, fuel systems, and site-specific shutoff procedures.

Appendix A: Additional Resources

For more information on EV charging solutions for grid-constrained sites, the following resources may prove helpful:

- **Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure** (U.S. Department of Transportation)
- **Public EV Charging Infrastructure Playbook** (Joint Office of Energy and Transportation)
- **Grid-Constrained Electric Vehicle Fast Charging Sites: Battery-Buffered Options** (Joint Office of Energy and Transportation)
- **Battery Energy Storage for Electric Vehicle Charging Stations: Technical Assistance Help Sheet** (Joint Office of Energy and Transportation)
- **Distributed Energy Resource Interconnection Roadmap** (U.S. Department of Energy)
- **Second-Life Electric Vehicle Batteries in Mobile Charging Systems** (Atlas Public Policy)
- **Flexible DER & EV Connections** (U.S. Department of Energy, Office of Electricity)
- **U-Finder** (U.S. Department of Energy)

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